DOCUMENT RESUME

ED 471 772 SE 067 031

AUTHOR	Barrett, Jeffrey E.; Jones, Graham A.; Mooney, Edward S.; Thornton, Carol A.; Cady, JoAnn; Olson, Jo
TITLE	Understanding Novice Teachers: Contrasting Cases.
PUB DATE	2002-00-00
NOTE	10p.; In: Proceedings of the Annual Meeting [of the] North American Chapter of the International Group for the Psychology of Mathematics Education (24th, Athens, GA, October 26-29, 2002). Volumes 1-4; see SE 066 887.
AVAILABLE FROM	ERIC/CSMEE Publications, 1929 Kenny Road, Columbus, OH 43210-1080. Tel: 800-276-0462 (Toll Free).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	Elementary Education; Knowledge Base for Teaching; *Mathematics Education; *Preservice Teachers; Professional Development; Teacher Attitudes
IDENTIFIERS	*Project PRIME

ABSTRACT

This study examined the classroom practice and beliefs of two novice teachers, Anne and Rachel, during the first year of their involvement in Project PRIME, a district-wide development program. Using accounts of practice (Simon & Tzur, 1999), the professional developer interviewed and observed the two novice teachers throughout the school year and established a hypothetical learning trajectory as part of their professional development. By the end of the first year, neither teacher's classroom practice reflected the goals of PRIME: using worthwhile mathematical tasks, questioning and promoting student's thinking. However, their practice was observably different and so were their beliefs about teaching. Anne's practice was consistent with the literature's characterization of a novice teacher, while Rachel's aligned more with that of a veteran teacher. These differences between these novice teachers proved to be an on-going challenge for professional development. (Author)

Reproductions supplied by EDRS are the best that can be made
from the original document.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

D. Owens

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

UNDERSTANDING NOVICE TEACHERS: CONTRASTING CASES

Jeffrey E. Barrett, Graham A. Jones, Edward S. Mooney,
Carol A. Thornton, JoAnn Cady & Jo Olson
Illinois State University
jbarrett@ilstu.edu

Tricia Guinee
Peoria School District, Illinois

This study examined the classroom practice and beliefs of two novice teachers, Anne and Rachel, during the first year of their involvement in Project PRIME, a district-wide development program. Using accounts of practice (Simon & Tzur, 1999), the professional developer interviewed and observed the two novice teachers throughout the school year and established a hypothetical learning trajectory as part of their professional development. By the end of the first year, neither teacher's classroom practice reflected the goals of PRIME: using worthwhile mathematical tasks, questioning and promoting student's thinking. However, their practice was observably different and so were their beliefs about teaching. Anne's practice was consistent with the literature's characterization of a novice teacher, while Rachel's aligned more with that of a veteran teacher. These differences between these novice teachers proved to be an-going challenge for professional development.

ED 471 772

A number of studies have addressed the beliefs and classroom practices of novice teachers (Borko et al., 1992; Leinhardt, 1989; Leinhardt & Greeno, 1986; Shealy, 1995; Shealy, 1994; Sherin & Drake, 2000). These studies define *novice* teacher as one with less than 3 years of teaching experience and one whose teaching tends to focus on "survival" (Miles & Huberman, 1994) and establishing basic classroom routines (Sherin & Drake, 2000). Most of the abovementioned studies have focused on novice teachers who have come directly from high school into pre-service teacher education programs. Hence, these studies may have produced characterizations of novice teachers that do not necessarily hold up for more mature-aged novice teachers. In this research, we bring a different perspective by comparing two novice teachers who brought contrasting experiences to their early years of teaching. More specifically, our study asked the following question: What were the beliefs and classroom mathematical practices of two novice elementary teachers during the first year of a professional development program?

Theoretical Orientation

The professional development program that served as the context for this study was Project PRIME (Thornton & Barrett, 2000), a systemic effort that focuses on enhancing the practice of elementary teachers working in a mid-size urban school district with a high minority student population. The key elements of PRIME are

SE 067 631

BEST COPY AVAILABLE

improving teachers' pedagogy and providing classroom-based support to facilitate implementation of a reform-based curriculum (TERC, 1998). More specifically we aim at enhancing teachers' development of three integrated instructional strategies: (a) posing worthwhile mathematical tasks, (b) asking responsive questions, and (c) listening to students' responses and promoting their thinking and engagement.

Accounts of practice (Simon & Tzur, 1999) provided the theoretical infrastructure for the case-study analysis of the two novice teachers in this study. Simon and Tzur describe accounts of practice as an approach for understanding teachers' current practice and as a means of viewing their current practice in the context of professional development programs that embrace envisioned reforms. Research that uses accounts of practice has two key elements: (a) the development of a conceptual frame, and (b) the use of the conceptual frame to trace teachers' classroom practice. The conceptual frame should be based on research in mathematics education and the particular perspectives and concerns of the researchers as they relate to the professional development project. The conceptual frame or lens in our study was based on PRIME'S three instructional strategies. We used these strategies as a lens to observe teachers' practice and beliefs. Using accounts of practice also provided an opportunity to ascertain why the teachers taught as they did.

The multifaceted nature of the accounts of practice methodology made it very appropriate for driving the collection of data to address the research question for this study. More specifically, we were able to use the conceptual frame to trace and interpret the teachers' beliefs and classroom mathematical practices captured through videotape and interview.

Method and Setting

The design for this study was in accord with the "accounts of practice" methodology (Simon & Tzur, 1999). We used case-study analysis to examine the beliefs and classroom practices of two novice teachers during the first year of PRIME.

Participants

The two novice teachers in this study were part of a pool of 337 teachers who agreed to participate in the 3 years of PRIME. These novice teachers, identified by pseudonyms, were also part of a random sample of 16 teachers selected for detailed case-study analysis. Both novice teachers were teaching Grade 1 classes. *Rachel,* a novice teacher in her first year of teaching, came into teacher education after having 20 years in the workforce. She taught for 1 year as a full-time teacher-aide prior to obtaining a teaching position. *Anne* had entered her teacher education program immediately following high school and was in her first year of teaching.

Procedure

During the PRIME summer workshop, prior to the first year of the program, the two teachers undertook a 1-week program that focused on ways that geometric con-

cepts can be built using tasks from *Investigations in Number, Data, and Space* (TERC, 1998). These TERC materials used by these two teachers were intended to support and enhance their mathematics curriculum in the coming years.

Working in collaboration with the second-named author, the first-named author wrote accounts of the teachers' classroom practice and beliefs during the fall and spring semesters. These accounts served as the basis for generating hypothetical learning trajectories (HLTs); that is, determining a plan, identifying activities, and conjecturing the way the teacher development process might go. We engaged teachers in a sequence of activities intended to highlight the relationship between mathematical tasks (like those contained in the TERC materials) and children's subsequent understandings.

Data Sources and Analysis

Data were gathered from four sources: (a) video tapes of two teaching sessions for each teacher, one in the fall and one in the spring; (b) detailed field notes of six teaching sessions during the intervention; (c) field notes of interviews associated with the six teaching sessions in each semester (two groups of three consecutive days); and (d) samples of students' work. Using a modification of Miles and Huberman' three-part analysis (1994), we used a double-coding procedure to analyze the video and field data in terms of the conceptual frame: PRIME's three integrated instructional strategies. The use of four sources of data and the generation of independent summaries and codes allowed for triangulation of the data in the sense that it enabled both confirming and alternative interpretations.

Results

Classroom Practices

Using the PRIME instructional strategies as a lens, the classroom practices of the two target teachers were analyzed during the first year of the program. The thick descriptors of Anne and Rachel's classroom practice are presented in Table 1.

With respect to *worthwhile mathematical tasks*, the outward manifestation of these two teachers' practice was similar: their students did not experience the TERC tasks in the way they were intended. Both teachers reduced the tasks to a sequence of simpler tasks. However, the teachers worked in different ways.

Anne gave her students' the opportunity to solve the problem but when the children reported she either left them hanging without feedback or led them inextricably to her solution. For example, near the end of the first year of the project, she posed this question: "Draw a cake in the shape of a rectangle and indicate how you and I could share it." The task was meaningful to the children, they seemed to understand that share implied *divide equally*, and the task had the potential to build understanding of mathematical concepts as well as to make connections between number and space. However, as we will see below, Anne did not use the children's responses to optimize the potential for the task.

Table 1. Classroom Practices

PRIME Strategies	Anne	Rachel
Worthwhile mathematical tasks	She is willing to let the children engage in thinking about worthwhile tasks, but lacks the confidence to implement her intent.	She demonstrates a steadfast resolve to reduce any worthwhile task to a procedural task that she can model for the children.
Questioning	Asks children to describe their solutions but rather than delve into their thinking leads them to her predetermined answer.	Her questions focus on checking that children use the correct procedure; she often seeks a response from the whole class to reinforce the procedure.
Listening and promoting students' thinking	She allows them to express their ideas; however, she does not feel comfortable analyzing and extending children's thinking	She assesses responses according to whether or not they follow her model; seldom seeks explanations as she sees the role of elaborating responses as her prerogative.

By way of contrast, Rachel broke the task into subtasks or more accurately subroutines that reduced the cognitive load of the problem. She often reminded the children of some of the procedures that had previously been established for solving problems like the one she was about to give. For example, near the end of the first year of the project she asked the students, "Which is longer than 2 inches, your fingernail or your hand?" Rather than let the children explore or even think about the task, Rachel immediately told them to look at their ruler, find 2 inches, and compare. Consequently the task was immediately reduced to a set of predetermined procedures that were not necessarily part of the children's mathematics.

With respect to *questioning*, Anne reflected what Brousseau (1992) calls the *Jourdain effect* (p. 20). By the Jourdain effect, Brousseau refers to a situation where the

teacher avoids having a discussion about knowledge with the student and instead recognizes a response of the students that has been stripped of meaning. In our situation, Anne started with open questions, encouraged students to convey their own meaning, but then avoided any follow-up discussion on the children's knowledge. The following dialogue in the cake-sharing example typifies Anne's Jourdain approach.

Anne: How could the cake be shared between you and me? Do it in you own way and be ready to tell me about it.

[Anne walked around while the students solved the problem, but did not question any students. Her only interaction was to remind one student that a rectangle was long "like a square but long."]

Anne [After about 3 minutes]: What are you looking for in this problem?

Children [In unison]: Two equal parts

Anne: And equal parts mean they're the...

Children [In unison]: Same

Anne: So, you cut it down the middle.

In spite of the fact that students had valid solutions with horizontal cuts, vertical cuts, and diagonal cuts, Anne did not pick up on these solutions in the dialogue. Even though she must have seen them she simply asked the students questions about equal parts when it was obvious that many of them had gone well beyond that level of understanding and had rich solutions to share.

By way of contrast, Rachel epitomized Brousseau's (1992) *Topaze-style*. That is, she used an instructional approach in which the students' response to a question is determined in advance and the teacher negotiates the conditions under which the response is produced. The following dialogue for the fingernail–hand problem was typical of her questioning:

Rachel: Who can tell me? Which is longer than 2 inches, your fingernail or your hand?

Student 1: Your fingernail.

Rachel: What do you think? [pointing to another child]

Student 2: Your hand.

Rachel: Your hand, that is correct. Why?

Rachel [without waiting for the children]: Because how big is an inch? Who can show me an inch?

Many children held their hands a foot apart, and were individually corrected. However, by now the original question had become submerged, marooned by a sea

of subroutines. In essence, Rachel's questions were not predicated on doing problem solving but on checking the various subroutines she had prescribed in advance.

With respect to *listening to and promoting students' thinking*, both teachers ultimately assessed children's responses against their own established standard. Using a Jourdain approach, Anne encouraged children to generate different representations but did not feel comfortable asking the children for explanations especially when a child was going in a direction different from the teachers' own solution. Rachel's Topaze-like strategy was clear from the outset: if the child's solution was correct (fitted her solution), she elaborated and explicated the student's solution; if the child's solution was incorrect, Rachel asked another child or represented her model without further discourse with the child.

In an overall sense Anne's classroom practice was often different from what she intended; that is, it was different from her professed intent to meet PRIME goals. By way of contrast Rachel's practice was consistent with "her" intent and she had already established the routines to meet her goals. Notwithstanding these differences, the end product of their classroom practice was much the same and was clearly inconsistent with the direction of the PRIME Project and the intent of the TERC (1998) resources.

Beliefs

The teachers' beliefs were identified during interviews with the first researcher. These interviews were undertaken as part of the accounts of practice methodology. Some of these beliefs arose in response to questions; others were volunteered by the teachers during discussion. The key beliefs identified for Anne and Rachel are listed in Table 2.

The beliefs of Anne and Rachel provide the essence of their classroom practice. Anne understands the key tenets of PRIME and is able to articulate them. She believes that children will produce different mathematical representations for problems and she thinks these representations may be helpful for instruction. However, she professes a lack of confidence in her own mathematics and this is reflected in her beliefs about children's mathematical thinking and her reluctance to use children's solutions to enable sense-making and the building of mathematical knowledge. By way of contrast, Rachel's beliefs seem to be more firmly held and her beliefs are consonant with her classroom practice. She is quite definite that children can't act mathematically on their own and as a consequence teachers must demonstrate the correct mathematical procedure and then ensure that children adopt the teacher's procedure. Rachel is steadfast in her belief that learning for "important" written tests and chapter tests will not occur through any other mechanism.

Discussion and Conclusions

This study examined the classroom practice and beliefs of two novice teachers during their first year of teaching and the first year of a professional development

Table 2. Beliefs

Anne	Rachel
Children will use different representations that may be helpful for instruction.	Children are unable to do mathematics independently of the teacher.
I have trouble constructing mathematical ideas; hence, my students will not be able to construct mathematical ideas.	Children learn math when I demonstrate the procedure that are to imitate.
Children will produce different solutions and representations but the textbook solution is the ultimate authority.	Children should produce the teachers' model solution; multiple solutions are likely to confuse the children.

program that had been adopted by their school district. The end product of each novice teacher's classroom practice was similar but they reached these states in different ways. From the perspective of the first two PRIME goals, Anne's classroom practice showed potential in that her mathematical tasks were often worthwhile and her initial questions opened up children's thinking. However, she lacked the confidence to use students' thinking to engage them in mathematical sense-making. In essence, Anne's practice was in direct contrast with her espoused beliefs that were consistent with PRIME instructional goals. In an overall sense, Anne's classroom teaching reflected that of a *novice* teacher in that her actions were consistent with the literature on novice teachers: specific goals not carried through (Sherin & Drake, 2000); frequent confusion caused by mis-sent signals (Leinhardt, 1989); struggles to listen to children's thinking (Fennema & Franke, 1992); dissonance between beliefs and practice (Cooney & Shealy, 1997); and lacking confidence in her own mathematics (Ball, 1990).

By way of contrast, Rachel's practice was deliberate and she was completely in control of an approach that seemed to be built on well-established routines, albeit routines that were not consistent with PRIME or reform directions in mathematics teaching. Rachel consistently reduced the cognitive load of worthwhile mathematical tasks, used Topaze-leading (Brousseau, 1992) when she questioned students, and assessed students' responses according to their fit with her own predetermined norm. Nevertheless, Rachel's classroom teaching tended to reflect that of a *veteran* teacher in that many of her actions were consistent with the veteran teachers literature: transparent system of goals (Leinhardt, 1989); detailed agenda and well established routines (Leinhardt & Greeno, 1986); minimal student confusion about what was required

of them (Leinhardt, 1989); and beliefs that were consonant with practice (Cooney & Shealy, 1997). Consequently, even though Anne and Rachel were both *novice* teachers they brought very different beliefs and actions to instruction, and these differences proved to be an-going challenge for the professional developer.

In accord with the ongoing cycle associated with *accounts of practice* (Simon & Tzur, 1999), we are refining the hypothetical learning trajectory for both teachers as we move into the second year of PRIME. Although we still intend to have both teachers focus on children's learning as their key goal, the activities and conjectured learning processes for each will be different. For Anne, the thinking of the students was distracting, confusing, and even anxiety building. Hence, we believe that she needs to be guided to study and discuss pertinent examples from her students' solutions, statements and questions. For Rachel, there is no evidence that she believes children are capable of building their own mathematical solutions. Hence we are intending to video tape the PD working with her class on open-ended problems that produce samples of children's work. Rachel and the PD will observe these videotapes together and analyze the children's work before any further attempt is made to have her adopt an approach to teaching that promotes mathematical sense making.

References

Ball, D. L. (1990). Prospective elementary and secondary teachers' understanding of division. *Journal for Research in Mathematics Education, 21*, 132-144.

Borko, H., Eisenhart, M., Brown, C. A., Underhill, R. G., Jones, D., & Agard, P. C. (1992). Learning to teach hard mathematics: Do novice teachers and their instructors give up too easily? *Journal for Research in Mathematics Education, 23*, 194-222.

Brousseau, G. (1992). Didactique: What it can do for the teacher. In R. Douady & A. Mercier (Eds.), *Research in didactique of mathematics* (pp. 7-39). Grenoble, France: La Pensee Sauvagek.

Cooney, T. J., & Shealy, B. (1997). On understanding the structure of teachers' beliefs and their relationship to change. In E. Fennema & B. Scott Nelson (Eds.), *Mathematics teachers in transition* (pp. 87-111). Mahwah, NJ: Erlbaum.

Fennema, E., & Franke, M. L. (1992). Teachers' knowledge and its impact. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 147-164). New York: Macmillan.

Leinhardt, G. (1989). Math lessons: A contrast of novice and expert competence. *Journal for Research in Mathematics Education, 20*(1), 52-75.

Leinhardt, G., & Greeno, J. G. (1986). The cognitive skill of teaching. *Educational Psychologist, 78*(2), 75-95.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis (2nd ed.)*. Thousand Oaks, CA: Sage.

Shealy, B. (1995). *Conceptualizing the development of two first-year secondary mathematics teachers' beliefs*. Unpublished Doctoral dissertation, University of Georgia, Athens.

Shealy, B. E. (1994). *Connecting orientation towards authority to first years's thinking about teaching*. Paper presented at the sixteenth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Baton Rouge.

Sherin, M. G., & Drake, C. (2000). *Contrasting models of curriculum use for novice and veteran teachers*. Unpublished manuscript.

Simon, M. A., & Tzur, R. (1999). Explicating the teacher's perspective from the researcher's perspectives: generating accounts of mathematics teachers' practice. *Journal for Research in Mathematics Education, 30*(3), 252-264.

TERC. (1998). *Investigations in number, data and space*. Menlo Park, CA: Seymour.

Thornton, C. A., & Barrett, J. E. (2000). *PRIME mathematics project, K-5*. Retrieved from http://www.math.ilstu.edu/dept/grants/PRIME

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

Reproduction Basis

[X] This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

[ ] This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").